Self-Organization in Network Glasses*

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Four elastic bars of roughly equal lengths joined at hinges form a square that is intrinsically *deformable*, or *floppy,* against shear. The square will become rigid and stress-free (or *isostatically rigid)* if a fifth bar is added as one of the diagonals. The square will become s*tressed rigid* if a sixth bar is added on the second diagonal. These ideas on mechanical stability of macroscopic structures have strikingly close parallels to those on random atomic networks found in glasses in which inter-atomic bonds play the same roles of cross-linking as elastic bars[1]. In particular, the *three elastic phases* of networks, *floppy, isostatically rigid and stressed-rigid* have now been identified in glasses at specific degrees of cross-linking (or chemical composition) both in theory[1] and experiments [2]. The *isostatically rigid phase* is identified with a *self-organized phase*[1,2], and has been observed in T-Modulated Differential Scanning Calorimetry and Raman scattering measurements; and a large compositional width for this phase is found[2] in several glass systems such as Si-Se and As-Ge-Se. Recently we have examined a ternary glass system containing a controllable concentration of one-fold coordinated (iodine) atoms, and observed a very narrow width[3] to the *isostatic-phase* centered precisely at the mean-field value of the rigidity transition, presumably because iodine atoms *randomly* scission the network and inhibit structural self-organization.

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